

ATTACHMENT A**Remarks**

By this Amendment, the specification and claims have been rewritten for better clarity. It is submitted that the present application is in condition for allowance for the following reasons.

Initially in the *Specification* section of the outstanding Office Action, the examiner required a substitute specification in proper idiomatic English. By this Amendment, a Clean Substitute Specification has been provided in Attachment B. In addition, a Marked Up Copy of the Clean Specification has submitted in Attachment C with markings showing all the changes relative to the immediate prior version of the specification of record. It is submitted that the substitute specification includes no new matter; which is readily evidenced by the marked up copy.

In the *Claim Rejections - 35 USC § 112* section, claims 1-10 were rejected for being indefinite; while in the *Allowable Subject Matter* section, it was indicated that claims 1-10 would be allowable if rewritten to overcome the § 112 rejection. Therefore, by this Amendment, claims 1-10 have been rewritten to be definite and to overcome the § 112 rejection. In view of these changes, it is submitted that claims 1-10 are now in immediate condition for allowance.

For all of the foregoing reasons, it is submitted that the present application is in condition for allowance and such action is solicited.

ATTACHMENT C

Marked Up Substitute Specification

Following herewith is a marked up copy showing the changes made from the previous specification to create the clean substitute specification contained in Attachment B.



BIT ASSEMBLY FOR A HAMMERING DRILL

FIELD OF THE INVENTION

[0001] The invention relates to a bit assembly for a hammering and rotating drill, in which The assembly includes a the main drill body is-arranged to drill essentially the a middle portion of the a hole, and In the main drill body there is mounted one or more outer hammering bits is-arranged to drill the an outer circle of the hole, and The mentioned outer circle of the hole drilling bits are arranged to drill a drilling surface, which is locateds further behind in the drilling direction than for the main drill body meant drilling surface, and that The mentioned outer bits are further mounted in a the main drill body in formed counter cavities, the axial directions of which have either the have a same direction as the drilling direction has or deviate outwards from it.

BACKGROUND OF THE INVENTION

[0002] Earlier There is known from patent publication FI-95618 a drilling apparatus in which the an outer circle of the hole drilling ring bit acts to drills the an outer circle, so that a casing tube can be pulled into the hole in connection with the drilling. However, when the drilling apparatus is pulled out from the hole so that the casing tube remains in the hole, the ring bit also has to remain in the hole bottom.

[0003] Also from patent publication FI-85302 there is known a drilling apparatus for drilling large holes in which apparatus in the centre locating bit drills the a hole centre portion, and separately on the outer circle of the drilling apparatus there are placed bits which drill the outer circle of the hole. The outer circle drilling bits need in this case have rotating and hammering devices of their own. The drilling apparatus can be applied is used for drilling of horizontal holes, so that when it the drilling apparatus is meant finally ultimately to penetrate through the ground into free space.

[0004] It is abundantly well known with a casing tube drilling eccentric drills where drilling is carried out by a rotating bit which is mounted eccentric in relation to a centre axis of the casing tube, and by means of which that it is possible to drill a larger hole than the diameter of the casing tube. When drilling is stopped, the eccentricity of the bit in relation to the centre axis

of the casing tube is changed, so that the bit can be pulled out from the hole and the casing tube is left in the hole.

[0005] The disadvantage for ~~these known solutions~~ is that in these drilling apparatuses in which the ring bit ~~is~~must be left in the hole, ~~is that~~ there is ~~then~~ lost in every hole ~~always~~ looses a relatively expensive bit. ~~The disadvantage~~ when used an eccentric bit ~~is used which must~~ ~~the bit~~ will be lifted up from the hole, ~~is that~~ ~~but~~ the bit will wear very quickly because the drilling surface in the bit is ~~remarkable~~ substantially smaller than the drilling surface of the hole, ~~so~~ that's why the worn bits have to be often ~~changed~~ often. In certain drilling apparatuses where the drilling bits can be pulled against each other thus allowing the bit assembly to be lifted up in spite of the casing tube, ~~the disadvantage is that~~ the mechanism by ~~means~~ of which the bits are pulled against each other has to be complicated, ~~and~~ it is difficult to change the bits and they can be very easily damaged.

SUMMARY OF THE INVENTION

[0006] By means of the bit assembly according to the invention, ~~in the above noted business area~~ existing problems can be unexpectedly solved, ~~and characteristics for~~ With the bit assembly according to the invention, ~~is that in there are~~ counter cavities mounted outer bits ~~which can be moved~~ at least a part of their way out of the counter cavities ~~be transported~~ out in the direction which deviates from the axial direction of the counter cavity in order to make the outer diameter of the hammering drilling unit smaller.

[0007] The advantage for the bit assembly according to the invention is that ~~the~~ a large hole drilling, ~~e.g.,~~ diameter 300 – 1000 mm, is possible by means of the hammering devices, ~~This is possible when~~ thanks to many separate outer hole drilling bits ~~in the drilling body~~ mounted ~~and only on~~ the outer circle of the ~~main~~ hole drilling bits ~~body~~, ~~so that~~ the total drilling surface area ~~of the main hole drill body becomes~~ is smaller than the ~~total~~ front surface area of the drilled hole. ~~Thus,~~ the bit assembly does ~~no~~'t need ~~to be~~ so effective and inconvenient~~ced~~ by a heavy hammer device, ~~than as compared~~ with corresponding drills whose bit is hammering against the whole drilling surface needed to provide the whole hole.

[0008] The separate outer circle drilling bits can also easily be changed. Further the outer circle drilling bits can be ~~according to the invention~~ mounted in the drill body in such a

way that when the bit assembly is pulled out from the hole, the bits ~~are moving~~move inwards at the casing tube edge, ~~and are thus~~ This allowing ~~allows~~ the pulling of the whole bit assembly out ~~and that while~~ the casing tube remains in the hole. In the solution of the present invention, no expensive drill bit is remaining in the hole and drilling becomes more advantageous.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] In the following the invention is more closely described by referring to the enclosed drawings, where

[0010] Fig. 1 shows a section view of the outer circle ~~of~~ hole drilling bit mounted in a drill body.

[0011] Fig. 2 shows a section view of an alternative bit mounting.

[0012] Fig. 3 shows a bit mounted according to figure 1 moving inwards at the casing tube.

[0013] Fig. 4 shows ~~a~~ the bit assembly of ~~the~~ fig. 1 seen from the front.

[0014] Fig. 5 shows an alternative bit assembly seen from the front.

[0015] Fig. 5a shows a section view of ~~the~~ an alternative bit mounting in a drill body.

DETAILED DESCRIPTION OF THE INVENTION

[0016] Fig. 1 shows a main drill body 1 for a hammering drill which drills, by means of its drilling surface, ~~at~~ level L1, essentially ~~the~~ a centre portion of ~~the~~ a hole. Many smaller bits 2 have been mounted in the main drill body 1 for drilling ~~the~~ an outer circle of the hole. The fitting surface for each bit 2 is a curved counter surface or cavity 7 whose curvature can also be radius R. The bits 2 drills a hole whose diameter is little larger than ~~the~~ that required for a casing tube 4 ~~needs in order to be able to follow with thereafter into the a drilled hole~~. ~~The~~ Each bit 2 is rotated ~~on~~ in relation to its ~~an~~ axis S of the associated counter surface 7 as shown, that's why it can be so that the bit 2 rotates in its counter cavity 7. The rotation is hoped desired and the rotation is secured obtained by ~~it that having~~ the drilling surface level L2 of the bit 2 is located further behind, in the drilling direction, ~~than~~ the drilling surface level L1 of the main drill body 1, and It will be noted that the bit 2 does no't drill by any other portion other than by the bit portion which in turn is locateds in the outer edge of the circle beyond the main drill body 1. There is

depicted in figure 4 presented an area 9, by which is the bit portion with which the bit 2 mainly drills. It will be appreciated that the rotation of the whole hammering drilling unit causes that such a moment is to be directed to the each bit 2, which moment causes rotates the bit 2 to rotate around its own the axis S.

[0017] The bit 2 can be mounted in the main drill body 1 by using as a help a separate bushing 5 which is placed into a hole drilled in the drill body 1. It is easier to machine in this kind of the bushing 5 and the needed counter cavities 7, as for example in the main drill body 1. In fig. 2 there is presented an alternative counter cavity assembly, which is formed to be step-like. Also Consistent therewith, the bit 2' has then a step-like design as well. The mounting of the bit 2, or 2' into the counter cavity and in the axial direction S which describes this as shown in the figures forms with the drilling direction preferably an angle α . The axial direction S of the counter cavity deviates so advantageously outwards from the drilling direction. The angle α is thus advantageously between 0 - 30°. The axial direction S of the counter cavity can possibly be the same as the drilling direction, as it is in the figure 5a. However, it facilitates a little the construction of the hammering drill unit if the angle α is larger than 0 as shown in figures 1-2.

[0018] The Figure 3 presentsdepicts, how the bit 2 of the bit assembly according to the invention is moveds to the side at by the casing tube 4, when the whole hammering drill unit is pulled out from the hole through the casing tube 4. The material of the arm 6 fixing the bit 2 has been is selected so that it allows the bit 2 to move out and to the side a needed distance as shown. The form shape of the counter surface 7 causes that the bit also to glides and turns inwards, so that and the bit 2 does no't at all move out in the axial direction S of the axis of the counter cavity. The casing tube 4 thus accomplishes carries out the moving of the bit 2. When the whole hammering drilling unit has been received taken out from the casing tube, the bit 2 will then move back into its counter cavity. The fixing arm 6 is, for example, spring-like and therefore stretchy, and it is needed required that fixing arm 6 it will bend at least in at one point. It can be manufactured of pull resistant materials totally or combined, wherein it can comprise separately a stretchy portion and separately a bending portion. Rubbers, plastics, fibre-fiber materials, steel springs or similar can become in question be used. The bending of the fixing arm can also be solved-accomplished by means of an articulated joint. In the drilling situation, the fixing arm 6

~~stresses-urges~~ the bit 2,-3 against the counter cavity. The fixing arm 6 and a possible holder part 8 will preferable rotate with ~~when~~ the bit 2 when it rotates.

[0019] In figure 5 there is depicted a bit 3 which has an angular form, wherein it and which does no't rotate in its counter cavity. The moving of the bit 3 out of the cavity as pushed by the casing tube 4 can, however, happen just in the same way as presented described for bit 2 or 2' in figures 2 and 3 (i.e., based on the curved or step-like side form). The bits 3 have always have the same portion-area in the drilling phase, wherein so that they bits 3 will wear a little sooner than the bits 2. The changing of the bits 2 and 3 takes, however, quite only a short time when the drill body 1 has been removed from the hole.

[0020] It will be appreciated that the bit assembly according to the invention becomes the cheaper as the larger holes are drilled. It will also be appreciated that the centre_r drilling surface bit will have a longer duration and smaller strain than if only one full-sized centre_r surface or bit will have when drilled the whole hole only by that one bit. Also the power required for the hammer device can be smaller of its power when the summarized effective bit surface area does no't correspond to the whole drilling surface of the whole drilling. It will further be appreciated that the drilling of the hole naturally takes a little more time when carried out by the way according to the invention, as compared with drilling by means of one bit by using a heavy hammer device which is needed.

[0021] In figure 5a there is depicted a section view of the unrotatable bit 3 where the bit 3 is locateds in its counter cavity. It will be appreciated that the axial direction S of the counter cavity is the same as the drilling direction. When the drilling unit is began to pulled out from the hole, the front edge of the casing tube 4 pushes the bit 3 so that the bit 3 begins to turns to the centre_r axis of the drill body 1 as depicted by the arrow. The arm 6 thus stretches and bends wherein so that the bit 3 is able to pass by the casing tube.

ABSTRACT

A bit assembly for a hammering and rotating drill, in which ~~assembly the a main~~ drill body (1) is arranged to drill essentially ~~the a~~ middle portion of the hole and in the main drill body (1) ~~there is~~ mounted one or more ~~hammering outer~~ bits (2),(3) is-arranged to drill ~~the an~~ outer circle of the hole. The ~~outer circle of the hole~~-drilling bits (2),(3) are arranged to drill an outer drilling surface, which is locateds further behind a middle drilling surface of the main drill body in the drilling direction, than for the drill body (1) meant drilling surface (L1) and that The mentioned outer bits (2),(3) are further mounted in ~~a-the~~ drill body (1) in formed counter cavities (7), the axial directions (S) of which have are either the same direction as the drilling direction ~~has~~-or which deviate outwards from ~~it~~ the drilling direction. and The mentioned outer bits can be moved at least a part of their way out of the counter cavities, in order to be transported out~~moved~~ in the a direction which deviates from the axial direction (S) of the counter cavity.